

WHAT IS CLAIMED IS:

1. An ink-jet printing apparatus having a main tank storing ink, a sub-tank releasably connectable with said main tank through an ink supply passage and a printing head for ejecting ink supplied from said sub-tank, for performing printing by ejecting ink from said printing head to a printing medium, comprising:

ink supply means for supplying ink from said main tank to said sub-tank through said ink supply passage within a period after completion of printing at preceding time and before starting printing at next time; and

ink draining means for performing ink draining for draining at least a part of ink remaining in said sub-tank within said period after completion of printing at preceding time and before starting printing at next time and in advance of ink supply by said ink supply means.

2. The ink-jet printing apparatus as claimed in claim 1, which further comprises:

measuring means for measuring any one of (A) a period after completion of printing at preceding time and before starting printing at next time and a power source being held OFF, (B) a period from turning OFF of the power source at preceding time to reception of a print start signal for starting printing at next time, (C) a period from completion of printing at preceding time to reception of a print start

signal for starting printing at next time, and (D) a period after completion of recovery process at preceding time to reception of a print start signal for starting printing at next time; and

5 control means for controlling whether ink draining process by said ink draining means is to be performed or not on the basis of a period measured by said measuring means.

10 3. The ink-jet printing apparatus as claimed in claim 2, wherein said control means controls to perform ink draining process by said ink draining means when a measured period is longer than or equal to a predetermined period and controls not to perform ink draining process by said 15 ink draining means when the measured period is shorter than said predetermined period.

4. The ink-jet printing apparatus as claimed in claim 1, which further comprises:

20 measuring means for measuring any one of (A) a period after completion of printing at preceding time and before starting printing at next time and a power source being held OFF, (B) a period from turning OFF of the power source at preceding time to reception of a print start signal for 25 starting printing at next time, (C) a period from completion of printing at preceding time to reception of a print start signal for starting printing at next time, and (D) a period

after completion of recovery process at preceding time to reception of a print start signal for starting printing at next time;

calculating means for calculating a value
5 corresponding to an amount of remaining ink in said sub-tank
at completion of printing at preceding time; and
control means for controlling whether ink draining
process by said ink draining means is to be performed or
not on the basis of a period measured by said measuring
10 means and value corresponding to remaining ink amount
calculated by said calculating means.

5. The ink-jet printing apparatus as claimed in claim
1, which further comprises:

15 measuring means for measuring any one of (A) a period
after completion of printing at preceding time and before
starting printing at next time and a power source being
held OFF, (B) a period from turning OFF of the power source
at preceding time to reception of a print start signal for
20 starting printing at next time, (C) a period from completion
of printing at preceding time to reception of a print start
signal for starting printing at next time, and (D) a period
after completion of recovery process at preceding time to
reception of a print start signal for starting printing
25 at next time;

calculating means for calculating a value
corresponding to an amount of remaining ink in said sub-tank

at completion of printing at preceding time; and
means for calculating a value corresponding to a
viscosity of remaining ink in said sub-tank at completion
of printing at preceding time;

- 5 calculating means for calculating a value
corresponding a viscosity of current ink on the basis of
the measured period, the calculated value corresponding
to remaining ink amount and the calculated value
corresponding to ink viscosity; and
- 10 control means for controlling whether ink draining
process by said ink draining means is to be performed or
not on the basis of the value corresponding to viscosity
of the current ink.

- 15 6. The ink-jet printing apparatus as claimed in claim
5, which comprises:

detecting means for detecting temperature and
humidity;

- storage means for storing history of temperature and
20 humidity during said period; and

correcting means for correcting a value corresponding
to viscosity of said current ink on the basis of said history.

7. The ink-jet printing apparatus as claimed in claim
25 1, wherein ink supply is performed by said ink supply means
to sub-tank containing said remaining ink before ink
draining process by said ink draining means during a period

after completion of printing at preceding time and before starting printing at next time.

8. The ink-jet printing apparatus as claimed in claim 5 7, which further comprises:

measuring means for measuring any one of (A) a period after completion of printing at preceding time and before starting printing at next time and a power source being held OFF, (B) a period from turning OFF of the power source 10 at preceding time to reception of a print start signal for starting printing at next time, (C) a period from completion of printing at preceding time to reception of a print start signal for starting printing at next time, and (D) a period after completion of recovery process at preceding time to 15 reception of a print start signal for starting printing at next time; and

control means for controlling to perform ink draining process after performing ink supply when a measured period is longer than or equal to a predetermined period and 20 controlling not to perform ink supply and ink draining process by said ink draining means when said measured period is shorter than the predetermined period.

9. The ink-jet printing apparatus as claimed in claim 25 7, which further comprises:

measuring means for measuring any one of (A) a period after completion of printing at preceding time and before

starting printing at next time and a power source being held OFF, (B) a period from turning OFF of the power source at preceding time to reception of a print start signal for starting printing at next time, (C) a period from completion 5 of printing at preceding time to reception of a print start signal for starting printing at next time, and (D) a period after completion of recovery process at preceding time to reception of a print start signal for starting printing at next time;

10 calculating means for calculating a value corresponding to an amount of remaining ink in said sub-tank at completion of printing at preceding time; and

15 control means for controlling whether said ink draining process is to be performed after performing said ink supply or not to perform both of said ink supply before ink draining process and said ink draining process on the basis of a period measured by said measuring means and value corresponding to remaining ink amount calculated by said calculating means.

20 10. The ink-jet printing apparatus as claimed in claim 1, which further comprises:

25 measuring means for measuring any one of (A) a period after completion of printing at preceding time and before starting printing at next time and a power source being held OFF, (B) a period from turning OFF of the power source at preceding time to reception of a print start signal for

starting printing at next time, (C) a period from completion of printing at preceding time to reception of a print start signal for starting printing at next time, and (D) a period after completion of recovery process at preceding time to 5 reception of a print start signal for starting printing at next time;

calculating means for calculating a value corresponding to an amount of remaining ink in said sub-tank at completion of printing at preceding time; and

10 means for calculating a value corresponding to a viscosity of remaining ink in said sub-tank after completion of printing at preceding time;

calculating means for calculating a value corresponding a viscosity of current ink on the basis of 15 the measured period, the calculated value corresponding to remaining ink amount and the calculated value corresponding to ink viscosity; and

control means for controlling whether said ink draining process is to be performed after performing said 20 ink supply or not to perform both of said ink supply before ink draining process and said ink draining process on the basis of the value corresponding to viscosity of the current ink.

25 11. The ink-jet printing apparatus as claimed in claim 1, wherein said ink draining means drains substantially all amount of flowable ink in said sub-tank.

12. The ink-jet printing apparatus as claimed in claim 1, which performs warming process for elevating temperature of ink in said printing head and ink in said sub-tank before 5 performing ink draining process by said ink draining means.

13. The ink-jet printing apparatus as claimed in claim 1, wherein ink draining process by said ink draining means is performed at one of a point of time taking turning OFF 10 of a power source as trigger, a point of time taking reception of a print start signal for starting next print as trigger, and a point of time of reception of print start signal for starting first print after turning ON of power source.

15 14. The ink-jet printing apparatus as claimed in claim 1, wherein ink draining process by said ink draining means is performed at one of a point of time taking turning OFF of a power source as trigger and a point of time taking 20 reception of a print end signal indicating end of printing.

15. An ink-jet printing apparatus having a plurality of main tanks storing inks, and a plurality of sub-tanks connected to a printing head and releasably connectable with said plurality of main tanks through respective ink 25 supply passages, comprising:

calculating means for calculating remaining ink amount in each sub-tank at completion of printing operation;

and

first draining control means for controlling draining of ink from each sub-tank on the basis of results of calculation by said calculating means so that remaining 5 ink amounts in said plurality of sub-tanks are substantially equal with each other.

16. The ink-jet printing apparatus as claimed in claim 15, wherein said first draining control means controls 10 draining of ink from each sub-tank so that remaining ink amounts in respective of said sub-tanks become substantially equal amount at the minimum amount among remaining ink amounts calculated by said calculating means.

15 17. The ink-jet printing apparatus as claimed in claim 15, which further comprises:

comparing means for comparing mutual difference of remaining ink amounts in respective of said sub-tanks calculated by said calculating means with a predetermined 20 value, and

said first draining control means controls draining depending upon result of comparison by said comparing means.

18. The ink-jet printing apparatus as claimed in claim 25 17, wherein said first draining control means controls draining of inks from respective sub-tanks so that remaining ink amounts in said plurality of sub-tanks become

substantially equal value with each other when said difference is greater than said predetermined value.

19. The ink-jet printing apparatus as claimed in claim 5 15, which further comprises second draining control means for draining remaining inks in said plurality of sub-tanks an amount equal to each other after draining by said first draining control means and before starting next printing operation.

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20. The ink-jet printing apparatus as claimed in claim 15, which further comprises negative pressure generating means for holding ink in said sub-tank, said negative pressure generating means is a porous body including foamed 15 body or fibrous body.

21. The ink-jet printing apparatus as claimed in claim 16, wherein a plurality of main tanks store inks colors of which are different from each other.